PURDUE SCHOOL OF MECHANICAL ENGINEERING

PURDUE UNIVERSITY Mechanical Engineering

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Seminar: Thursday, March 10th - 9:00 AM
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Virtual Link: https://bit.ly/novel-semiconductor

Novel Semiconductor and Interconnect Materials for Energy and Flexible Electronics Applications

Abstract:

Compound semiconductors such as 2D/3D halide-chalcogenide perovskites and multinary chalcogenides offer attractive properties for many applications including photovoltaics (PV), light-emitting diodes (LEDs), photocatalysis, Na-ion solid state batteries and flexible electronics. Further, to revolutionize next generation flexible and robust electronics, stable and reliable interconnects/interfaces are needed for heterogeneous multi-die integration into one platform. The current presentation will explore design, processing, device integration and reliability of halide-based perovskites and multinary chalcogenides. (1) The first part of the talk will discuss Pb-free halide perovskite compounds with exciting optoelectronic properties (e.g. high absorption coefficient, long carrier lifetimes and tunable bandgap) deposited via solution processing. Investigations on the effect of A and B cation substitutions on the dimensionality and optoelectronic properties will be presented. Potential applications and advanced manufacturing methods for these halide perovskites will also be discussed. (2) The second part of the talk will focus on physics-based life-prediction models for semiconductor materials and electronic packages in multi-stress environments. Metastability and long-term degradation in optoelectronic materials often depends on evolution of point defects and their interaction with extended defects such as grain boundaries, interfaces and charge extraction layers. An integrated approach of first principle calculations, *in-operando* characterization and defect kinetics model will be presented for energy yield prediction of thin-film chalcogenide solar cells. This approach will then be extended to predict the lifetime of Au-Ni, Ni-W and Sn-Sb interconnects for advanced electronics packaging. The talk will be concluded with candidate's teaching and research vision in electronics packaging and reliability.

Biography:

Dr. Shubhra Bansal is an Associate Professor in the Department of Mechanical Engineering at UNLV. Her research interests include development of halide perovskites and chalcogenides for electronics applications and understanding the role of defects in electro-optical and thermo-mechanical degradation of electronic devices and packages. She completed her undergraduate studies in Metallurgical & Materials Engineering from the Indian Institute of Technology- Roorkee in 2001. She received her M.S. and Ph.D. in Materials Science and Engineering from the Georgia Institute of Technology in 2006. She worked as a Lead Materials Scientist in GE Global Research, Niskayuna from 2006-2011. Before joining academia, she also served as a Senior Technical Advisor for the Department of Energy. Her research at UNLV is funded by DOE-EERE, NSF and NASA. She is a recipient of the prestigious NSF CAREER Award and serves as the Associate Editor of Solar Energy Journal, and Session Chair for 49th IEEE PVSC Thin-film chalcogenide session. She has a Google Scholar h-index of 14.

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